



Dual-Core Intel® Xeon® Processor-based DP Workstations

Superior Performance to Improve How
People Work and Create Every Day







Achieve Your Goals with Intel Built In

With more complex designs and an overwhelming desire to push the envelope of creative and scientific possibilities, your challenges get tougher every year. Yet, these are what drive us at Intel to take the next leap in technologies so you can reach your objectives. With Intel® technologies built into your work environment, you can build success into your business.

Intel continues to build more capabilities into platforms so you can do much more with a lot less. For over 30 years, Intel has helped developers and businesses solve their toughest problems with advanced computing capabilities and technologies – from the first multi-purpose processor in 1974 to today's advanced, dual-core, 64-bit processors and comprehensive platform technologies. We give you a combination of effective technologies, software services, and industry alliances, so you can optimize your work environment to solve your most complex problems.

Our next step in technologies helps you be more productive

Workstations based on new Dual-Core Intel® Xeon® processors integrate greater processing capabilities, faster I/O and graphics, and increased memory capacity. These dual-core workstations help improve productivity, enhance visualization, and improve flexibility to help designers, engineers, and content developers achieve more in less time.

Dual-core capabilities are just the beginning.

At Intel, we recognize that development requirements mean more than creating processors that deliver greater performance. That's why we will continue to provide platform-based solutions that optimize performance, improve throughput, and add new embedded technologies that give engineering, creative, and scientific professionals the tools to solve problems faster, process larger data sets, and meet bigger challenges.

Get More Done in Less Time

Professional workstations based on Dual-Core Intel Xeon processors are ideal for today's users. These next-generation workstations integrate capabilities for flexibility and productivity, helping you get more done in less time, while improving your experience.

Fast time-to-solution

Product design, digital content creation, and financial analysis get the performance and headroom they need for running parallel tasks, such as background rendering, multiple simultaneous queries and display, or lengthy load calculations. The ability to run demanding, multitasking, multi-threaded applications is built in with 64-bit, dual-core processing engines.

Quick visualization

Enhanced graphic capabilities enable real-time, smarter decisions for workstation users. Compute-intensive graphics, visual Internet applications, scientific analysis, and engineering design all benefit from performance-enhancing technologies, such as Fully Buffered DIMM (FBDIMM) technology, PCI Express* (PCIe*), large on-chip cache, and enhanced visualization capabilities.

Flexible work environment

Virtualization is a capability that allows a user to turn a single workstation into two or more "virtual" computers. By allowing a single system to run two or more operating systems simultaneously, virtualization gives you the ability to do more things at once without the need to have multiple systems in your office. Virtualization also helps isolate viruses or program faults and resolve problems without affecting other programs on the same workstation. Hardware-assisted virtualization, with Intel®

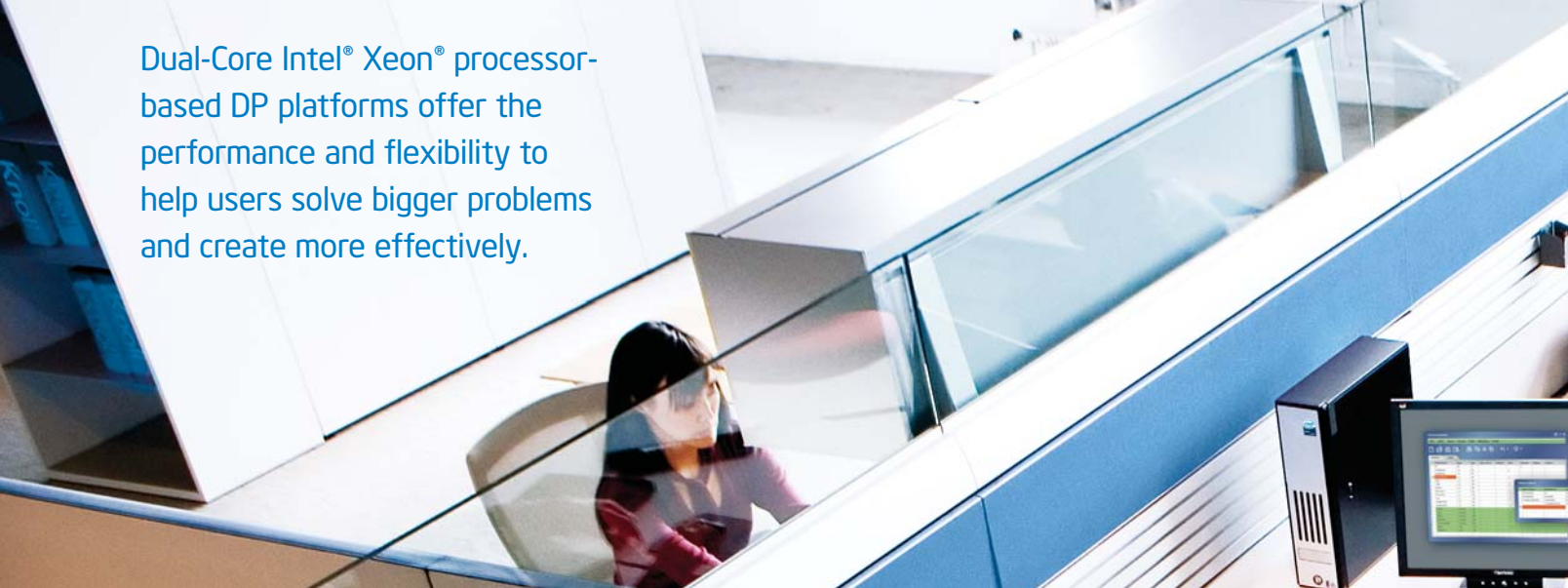
Virtualization Technology,¹ offers even more flexibility and allows you to optimize performance, software compatibility, and reliability in many work environments.

Office friendly

Embedded Intel technologies help workstation manufacturers offer better acoustics to improve the workstation user-experience. Intel's comprehensive strategy to reduce thermal loads and associated cooling requirements, add innovative platform power management technology, and develop future products with reduced power consumption while increasing processor performance, can help reduce work environment noise while improving productivity.

Improved reliability

Our new workstation platforms build in rock-solid reliability and enhanced security to help you stay productive – even in the case of hard failures, such as a downed processor or failed memory module. Error Correcting Code (ECC) and other processor and chipset enhancements protect the integrity of your data as it moves from the network to system memory to processor and back again. Plus reliability, availability, and serviceability features found in new FBDIMM technology and PCI Express (PCIe) help create a platform you can rely on. You'd expect nothing less from Intel's proven track record for delivering reliable systems.



Dual-Core Intel® Xeon® processor-based DP platforms offer the performance and flexibility to help users solve bigger problems and create more effectively.

Innovative Technologies and a Flexible, Balanced Platform Help Drive Faster Solutions

Build in productivity with balanced platforms

Balanced workstations based on Dual-Core Intel Xeon processors are ideal for today's demanding applications in computer aided engineering (CAE), electronic design automation (EDA), digital content creation, financial analysis, oil and gas exploration, and software engineering. You can render faster, analyze and display more data with higher fidelity, and speed visual comparisons. Platform memory and I/O performance enhancements, coupled with Intel® embedded technologies and Intel® software optimization tools help your 32- and 64-bit applications process more data, faster and run more complex modeling and analyses, giving users the tools to be more productive and creative.

- Dual-core, 64-bit computing.
- New dual independent buses between processors and chipset at up to 1333² MHz speed processor throughput up to 3X (21 GB/s @ 1333 MHz)³.
- Enhanced 4M L2 cache keeps more critical data closer to each processor core.
- FBDIMM technology provides enhanced system throughput for faster access to memory and more reliable memory performance.
- Up to 64 GB of memory capacity enables processing of larger data sets for faster solutions to complex problems and enables enhanced memory-based reliability and availability.
- High-speed x16 PCI Express link for enhanced visualization and graphics support.
- Intel® I/O Acceleration Technology⁴ (Intel® I/OAT) can improve network throughput by up to 30 percent³ to keep data moving through the system.



Take the next leap in workstation memory technology

New FBDIMM technology is the next advance in system memory, providing greater capacity and enhanced performance for complex problem solving and image rendering. FBDIMM technology enables 4X the memory capacity (up to 64 GB) and up to 3X the throughput of previous-generation Intel® E7525 chipset platforms with DDR2-400 memory. Dual-Core Intel Xeon processor-based DP workstations with FBDIMMs boost system responsiveness for data-intensive applications.

FBDIMMs offer flexible implementations to help companies boost memory resources above their older systems while managing system costs. With Dual-Core Intel Xeon processor 5000* sequence-based platforms supporting up to 16 DIMM slots, businesses have more flexibility to choose memory configurations that best fit within their budgetary needs without sacrificing their performance requirements.

FBDIMM replaces the parallel stub busses used in prior workstation platforms with high-speed serial links that operate at much higher speeds for faster response, enable greater memory capacity, and improve reliability, availability, and data integrity. A new Advanced Memory Buffer (AMB) on each DIMM board communicates with the memory controller and industry-standard DIMMs. Using standard DIMMs, FBDIMM technology enables increased memory capacity and responsiveness while minimizing impact on the memory industry and workstation memory upgrades. FBDIMM technology utilizes existing DDR2 technology and will support emerging DDR3, ensuring the ability to take advantage of performance increases offered by today's and tomorrow's components.

Workstations based on the latest Dual-Core Intel Xeon processors with FBDIMMs are optimized for fast data access and processing using new Intel I/O Acceleration Technology to further improve overall system performance and response. Integrating both FBDIMM technology with Intel I/OAT helps create a balanced platform for demanding applications.

Embedded technologies improve performance, reliability, and security

Enhance performance and visualization for graphics and I/O-intensive applications with PCI Express*

PCI Express (PCIe) has become the mainstream I/O technology for high-end, advanced workstations. It provides the necessary bandwidth and lower latency to meet the demanding I/O needs of dual-core computing workloads. A PCIe x16 link for graphics support helps deliver up to 8 GB/s throughput for enhanced visualization, while PCIe x8 links help provide up to 4 GB/s throughput for expansion I/O devices. The lower latency and the increased bandwidth help deliver the throughput required to fully utilize the processor's improved capabilities, move more data faster, and speed time-to-solution and graphic visualization.

Add greater flexibility to workstations using enhanced virtual environments with Intel® Virtualization Technology

Virtualization allows developers to run multiple environments on a single workstation for greater flexibility and utilization from the same system. Running simultaneous environments allows concurrent development and software validation under different environments and even different versions of the same operating system. Intel expands the capabilities, flexibility, and security of virtual environments with new Intel Virtualization Technology – a hardware-assistance technology for software-based virtual environments.

Until now, virtual environments were primarily limited to 32-bit applications and operating systems, and some legacy environments could not run in a virtual environment without modifications. With Intel Virtualization Technology you can now run 64-bit operating systems and applications alongside 32-bit environments on the same system. Intel's new technology also reduces system vulnerability from software-based attacks and software faults, helping improve security, reliability, data integrity, and service uptime.

Intel has worked with the leading operating system and virtualization software companies, such as VMWare, Microsoft, and XenSource, to enable hardware-assisted virtualization. Intel's hardware-assistance is built into the processor and enabled by operating systems and virtualization software designed to support Intel Virtualization Technology.

Boost overall system performance with Intel® I/O Acceleration Technology

Intel I/OAT enhances supported workstations with improved network throughput for added application responsiveness. Compared to standard Gigabit Ethernet, Intel I/O Acceleration can increase data movement by as much as 30 percent.³ Intel I/OAT is a platform innovation that includes the following:

- Processor enhancements: accelerated protocol stacks optimized for Intel architecture improves data access.
- Dual-Core Intel® 5000 Series chipset enhancements: data copying offloaded from the CPU to the chipset moves data faster.
- Intel® Ethernet Controller enhancements: parallel processing of data and commands supports better data flow to and from the network.

Make workstations more office-friendly with Demand-Based Switching

Using our expertise and leadership in mobile computing, we are enhancing workstation computing with new power-saving technologies, from the processor's microarchitecture to technologies embedded in the platform. Enhanced Intel SpeedStep® technology enables power management features that match processor power consumption to application performance, resulting in up to 24 percent energy savings. When utilization is high and the processor demands maximum performance, the processor is automatically switched to a high operational state. When CPU utilization drops, it is switched to a lower power state without impacting application performance. Maximum power conservation occurs during idles periods, when demand is at its lowest. Demand-Based Switching reduces energy consumption and possibly lowers acoustic impact from fans, helping make workstations more office-friendly.

Proven virtual environments can now support 64-bit operating systems and applications alongside 32-bit virtual environments with Intel® Virtualization Technology.

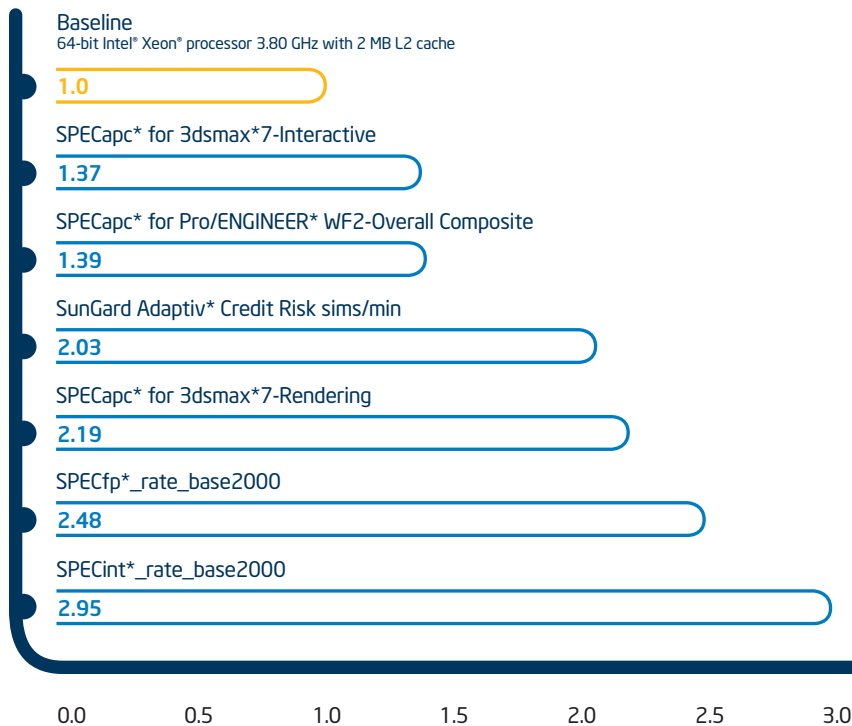


Dual-Core Intel® Xeon® Processor-based Workstations Overview

Platform Feature	User Benefit
Dual-Core Intel® Xeon® processors	<ul style="list-style-type: none"> Up to 2 times performance versus previous-generation Intel® E7525 chipset platforms with DDR2-400 memory Up to 3 times performance/watt
Dual independent buses (1066 MHz and 1333 ² MHz)	<ul style="list-style-type: none"> Up to 17 GB/s with 1066 MHz and up to 21 GB/s with 1333 MHz
Intel® Extended Memory 64 Technology ⁵ (Intel® EM64T)	<ul style="list-style-type: none"> Enables extended physical memory addressability beyond 4 GB, for memory-intensive applications
Fully Buffered DIMM technology (533 MHz and 667 MHz memory speeds)	<ul style="list-style-type: none"> Provides up to 3 times³ increase in memory bandwidth over DDR2-400 Up to 4 times³ memory capacity for as much as 64 GB Enhanced RAS features for higher service uptime
PCI Express* serial I/O	<ul style="list-style-type: none"> Next-generation I/O capable of up to 8 GB/s peak bandwidth with x16 link One x16 link for enhanced visualization; one configurable x8 link for peripheral support Improved RAS features compared to PCI-X* Lower latency compared to PCI-X for improved I/O performance Software compatible with PCI-X to simplify parallel-to-serial transition
Enhanced reliability and manageability	<ul style="list-style-type: none"> Many memory controller features, together with PCI Express RAS features combine to help improve platform reliability vs. previous-generation Intel E7525 chipset platforms with DDR2-400 memory New features include Error Correcting Code (ECC) system bus, new memory RAID, and I/O hot-plug
Intel® I/O Acceleration Technology ⁴ (Intel® I/OAT)	<ul style="list-style-type: none"> Helps improve network throughput in platforms with operating systems supporting Intel I/O Acceleration Technology
Demand-Based Switching (DBS) with Enhanced Intel SpeedStep® technology	<ul style="list-style-type: none"> Enables platform and software power management features to help lower average power consumption while maintaining application performance and improving acoustics
Intel® Virtualization Technology ¹	<ul style="list-style-type: none"> Enables added flexibility and productivity in some workstation environments Enables 64-bit OSs and software to run over today's popular virtualization software Improves security of virtual environments and robustness of virtualization software Developed with virtualization software providers to enable greater functionality, robustness, and compatibility compared to non-hardware-assisted virtual environments

Over 2x workstation performance using 64-bit Dual-Core Intel® Xeon® processors over previous Intel® generations

Using Dell Precision* Workstations



Relative performance reported normalized to the baseline platform configuration score. Higher scores indicate better performance. Comparison based on published result, Intel C/C++ and Fortran Compiler 9.1 used for building binaries. Results posted in white paper on Dell.com as of May 23, 2006.

SunGard Adaptiv* Credit Risk Analysis: This financial benchmark uses a Monte Carlo method to analyze company "D" portfolio – completion time reported as simulations per minute.

SPECint*_rate_base2000: This compute-intensive benchmark evaluates the integer throughput of the measured system.

SPECfp*_rate_base2000: This compute-intensive benchmark evaluates the floating point throughput performance of the measured system.

SPECapc* for 3ds max* 7 – Rendering score: Geometric mean of four workloads rendered as part of the SPECapc* suite of benchmarks representing typical digital content creation (DCC) performance.

SPECapc* for 3ds max* 7 – Interactive score: Geometric mean of many workloads representing graphics, driver, CPU and I/O performance.

SPECapc* for Pro/ENGINEER* Wildfire 2.0 (WF2) – Composite score: Weighted geometric mean of graphics, CPU, I/O, and File Time scores represents typical Mechanical Computer-Aided Designers (MCAD) performance.

Baseline Platform configuration: Dell Precision* 670 Workstation platform with two 64-bit Intel® Xeon® processors 3.80 GHz with 2 MB L2 cache, Microsoft Windows* XP Professional SP2, 4x1024 MB DDR2-PC3200 DIMM 400 MHz CL3 (total 4 GB), Western Digital WD800JD* SATA Hard Drive (7200 RPM, 8 MB cache), NVIDIA Quadro* FX4500 PCIe* graphics card with driver 81.76. Intel Hyper-Threading Technology enabled on SPECapc* for 3ds max* 7 & SunGard ACR*. SPECint*_rate_base2000/SPECfp*_rate_base2000 from <http://www.spec.org> published Oct-2005 using Intel Compiler 9.0.

New Platform configuration: Dell Precision* 690 Workstation platform with two Dual-Core Intel® Xeon® processors 5160 (3.00 GHz, 1333 MHz FSB, 4 MB L2 cache), Microsoft Windows* XP Professional SP2, 8x 1024 MB FB DIMM 667 MHz (total 8 GB), Western Digital WD800JD* SATA Hard Drive (7200 RPM, 8 MB cache), NVIDIA Quadro* FX4500 PCIe* graphics card with driver 81.76.

*SPECint*_rate_base2000/SPECfp*_rate_base2000 tested on Microsoft Windows* XP Professional x64 Edition submitted to SPEC to be published May 2006 using Intel Compiler 9.1.

Disclaimers:

Relative performance for each benchmark is calculated by taking the actual benchmark result for the first platform tested and assigning it a value of 1.0 as a baseline. Relative performance for the remaining platforms tested was calculated by dividing the actual benchmark result for the baseline platform into each of the specific benchmark results of each of the other platforms and assigning them a relative performance number that correlates with the performance improvements reported.

Performance tests and ratings are measured using specific computer systems and/or components and reflect the approximate performance of Intel® products as measured by those tests. Any difference in system hardware or software design or configuration may affect actual performance. Buyers should consult other sources of information to evaluate the performance of systems or components they are considering purchasing. For more information on performance tests and on the performance of Intel products, reference http://www.intel.com/performance/resources/benchmark_limitations.htm or call (U.S.) 1-800-628-8686 or 1-916-356-3104.

Stay Productive with Superior Reliability and Availability

Dual-Core Intel Xeon processor-based workstations build in reliability with FBDIMM technology and PCI Express to help keep you productive longer.

Intel® 5000X chipset RAS features

Enhanced reliability is integrated in the Intel 5000 Series chipsets, offering a high degree of memory error detection and correction, data protection, and serviceability.

Memory mirroring — Gives the option to duplicate system memory, protecting against uncorrectable errors or DRAM failure. Memory mirroring allows continued operation and data availability.

Memory sparing — Allows you to reserve spare memory capacity that can be used if current memory fails.

X8 Single Device Data Correction (X8 SDDC) — Allows you to fix the failure of an entire DRAM device on-the-fly by removing a single DRAM from the memory map and recovering its data into a new device.

Demand scrubbing — The system proactively searches the system memory, repairing correctable errors or permanently marking the memory location as unreadable.

Error Correcting Code (ECC) — The system detects single-bit and double-bit errors and automatically corrects single-bit errors on internal data paths. Plus, CRC and error correction on address, command, and data paths help boost system reliability and availability.

Hot-plug I/O — Add I/O after installation without service interruption.

For more information about Dual-Core Intel® Xeon® processor-based workstation platforms, please go to www.intel.com/business/workstation







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¹ Intel® Virtualization Technology requires a computer system with a processor, chipset, BIOS, virtual machine monitor (VMM) and applications enabled for virtualization technology. Functionality, performance or other virtualization technology benefits will vary depending on hardware and software configurations. Virtualization technology-enabled BIOS and VMM applications are currently in development.

² 1333 MHz bus available in 2nd half of 2006.

³ Performance comparison to Intel® Xeon® processor (single-core) Intel® E7525 chipset platforms with DDR2-400 memory.

⁴ Intel® I/O Acceleration Technology requires an operating system that supports the technology.

⁵ 64-bit Intel® Xeon® processors with Intel® EM64T requires a computer system with a processor, chipset, BIOS, OS, device drivers and applications enabled for Intel EM64T. Processor will not operate (including 32-bit operation) without an Intel EM64T-enabled BIOS. Performance will vary depending on your hardware and software configurations. Intel EM64T-enabled OS, BIOS, device drivers and applications may not be available. Check with your vendor for more information.

⁶ Intel processor numbers are not a measure of performance. Processor numbers differentiate features within each processor family, not across different processor families. See http://www.intel.com/products/processor_number for details.

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